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ABSTRACT

The authors' review of several studies on school district fiscal response to state aid formulas precedes a summary of their research results from case studies of Colorado and Minnesota. The studies reviewed examined factors influencing district fiscal capacity and expenditure changes made in response to aid formulas, especially to formulas' "fiscal price" aspects (where additional aid is made dependent on district tax rate increases). In the summary of research on Colorado and Minnesota, both of which have modified guaranteed tax base formulas, the authors examine numerous variables' effects on district fiscal response and note the elasticity of the responses. The variables covered include household income, residential property values, state and federal aid, the formulas' fiscal price effects, pupil density and growth rate, percentage of minority pupils, and number of districts per square mile in a district's surrounding region. In their conclusions the authors discuss modifications in state aid formulas, including weighting for income and other variables, and long term changes in such factors as property values and fiscal capacity. A lengthy appendix provides 10 tables showing the Colorado and Minnesota results and also lists the data sources. (RW)

Paper No. 12

TAX BASE COMPOSITION AND FAMILY INCOME IN MEASURING SCHOOL DISTRICT FISCAL CAPACITY

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INTRODUCTION

In an era of school finance reform where greater equalization of resources per pupil or available tax bases is taking place, an important issue is what determines how a school district responds to internal and external fiscal incentives and constraints. Without a significant equalization program at the state level, school district expenditures per pupil are primarily determined by the district property tax base per pupil. But as the role of the state and federal governments become increasingly important in school finance, other elements gain a more significant place.

This paper summarizes some recent work by the authors on various factors that influence school district spending and spending from locally raised taxes; Colorado and Minnesota are the states used for a case study. The factors include the levels of state and federal aid; the nature of the state general aid formula; local fiscal characteristics including the average market value of residential housing, the percent of the property tax base that is residential and average household income; and various social and demographic characteristics including district size in terms of number of pupils, growth rate and factors that may be associated with the costs of education inputs.

Although the title of the paper refers only to tax base composition and income, economic factors that have been in the forefront of recent discussions of expanded measure of school district fiscal capacity, it is the contention of the present writers that a broader approach to the fiscal capacity question must be taken. Basically, our approach is to examine, analytically and statistically, those factors that influence school district spending and then use the observed behavioral relations to produce "weights" for income and other local economic factors to insert in standard state aid formulas.

I. RECENT STUDIES OF SCHOOL DISTRICT FISCAL RESPONSE AND CAPACITY

Theoretical and statistical studies of the fiscal behavior of state and local governments have been a topic in applied public finance for some years. The expenditure and tax behavior of local governments with respect to such factors as state and federal aid, median family income and demographic characteristics have been studied at length.[1]

Sophisticated analyses of school district fiscal behavior have been relatively recent. These have been inspired in part, perhaps, by the new interest in school finance reform in the 1970s and particularly by the nature of some proposed and actual reforms. Of special interest have been the types of formulas based on percentage equalization or guaranteed tax bases. These formulas may be contrasted with the older, more familiar foundation types of state aid programs from an economic standpoint in that there are not only "income effects", but also "price effects" in the new aid formulas. That is, school districts are not only recipients of state government grants, equalizing or otherwise, over which the recipient districts exercise no direct control. They also may receive variable grants that depend in part on the property tax rates that the districts themselves decide to impose. Thus districts receive not only specific amounts of "income" from the state, but also face a "price" for receiving additional amounts of state aid or making additional total expenditures.

For example, under a guaranteed tax base type of system, the following is a typical simple form:

State aid per pupil = (Property tax base per pupil that is guaranteed
x Districts property tax rate)
- (District's actual property tax base per pupil
x District's property tax rate)

Thus, what the district receives from the state government as equalizing aid will depend not only on the tax base that is guaranteed by the state (presumably above the district's actual tax base), but also on the tax rate the district decides to set. State aid will rise when the district sets a higher property tax rate, but this additional aid has a "price" (cost) since additional local tax dollars will be spent at the same time.

In contrast, the older foundation type of formula is set up such that only an "income effect" will exist. A simple formulation is the following:

State aid per pupil = (Foundation (minimum) level of support per pupil)
- (Required district property tax rate
x District's property tax base per pupil).

Thus, the amount of aid is outside the district's direct influence.[2] The district's expenditures will be influenced more as if it simply received a flat grant of additional "income".

A few studies have examined the newer percentage equalizing or guaranteed tax base types of state aid formulas in terms of "matching rates" such as the additional local dollars that are necessary to obtain an additional dollar of state aid or to spend an additional dollar of combined state and local funds. Such a matching rate concept is like the familiar matching provisions of federal grants to state governments for highways or urban renewal. Such formulas are still in the minority across states, however.

Many other factors affect expenditure decisions by school districts in addition to the amounts of aid received from the state and federal government and the nature of the state aid formula. These include the residential or total property value per pupil in the district, the average income of its families and the percentage distribution of property value in terms of residential versus nonresidential.

Although property value per pupil is the tax base for spending local funds in nearly every state in the nation, other local financial characteristics may affect decisions to spend. For example, differences in income per family for two districts that have equal property values per pupil may lead to differences in per pupil spending, even in a case where property tax bases have been highly "equalized" through state aid formulas that guarantee either minimum spending levels (foundation formulas) or guaranteed property tax bases. Similarly, it has been argued that for two otherwise equal districts, the district with a higher proportion of its property value in residential property will tend to spend less. The latter's tendency to spend less may be because residential taxpayer-voters will see more of the tax burden of additional spending falling on them than in a community whose tax base is much more heavily commercial and industrial.

Feldstein and Ladd[3] have made perhaps the most discussed contributions to the fiscal response literature in the past few years. These articles treat in detail both the issues of how state aid formulas with a "price" variable and how local fiscal capacity measures other than total assessed value of property per pupil may affect local expenditure decisions. Both used Massachusetts data around 1970 for their empirical tests.

In her "Local Education Expenditures..." article, Ladd sets up a statistical model of school district expenditure behavior based on several arguments. A major argument is that local taxpayer-voters will face one type of price relationship based on the relative proportion of residential property in the district. She describes how voters may take into account what they believe to be the extent of "shifting" of property taxes outside the district through the tax share paid

directly by commercial and industrial property. All property taxes on residential property are assumed to be borne by residents -- whether renters or owner-occupiers.

Another major issue addressed by Ladd is the division of Massachusetts state aid to local education into three components. First, the Massachusetts aid formula in 1970 gave school aid in part on the basis of a matching rate, i.e., the number of state dollars received per local dollar raised, a rate that varies inversely with the per pupil property tax base in a district. Other basic aid was nonmatching and there was also aid for categorical programs.

Finally, Ladd adds other economic and demographic factors to the statistical analysis including median family income (U.S. Census -- 1969 data), public and private school students in proportion to the district population, professional and related workers relative to the population and a measure of families with poverty-level income.

In all of her tests, nearly every variable is statistically significant and always of the expected sign; e.g., a one percent increase in the residential fraction of the property tax base may lead to between a 0.3 and 0.7 percent decrease in total district spending per pupil. Similarly, an increase in the "price" embedded in the state aid formula will lead to a decrease in expenditures.

Ladd further utilizes these results to indicate how a district's fiscal capacity can be measured on the basis of more than just its assessed value. And in her follow-on article cited above, "State-Wide Taxation...," she uses the results of the previous article to demonstrate how taxation of commercial and industrial property on a statewide rather than district basis in Massachusetts may lead to undesirable results: "... because of the positive correlation between the faction of families in poverty and the commercial/industrial nature

of the community ... if the goal of the policy shift is to reduce the variation in expenditures and to increase expenditures in low income or low wealth communities, removing the business component of the tax base with no compensating state aid would be counterproductive."[4]

Although they did not work together directly, Feldstein also bases his statistical work on Massachusetts data around 1970. His statistical results are fairly similar, although estimates of the numerical relationships vary from Ladd's to some extent. But Feldstein's emphasis is even more on the problem of financing local education that neutralizes for the effects of local wealth, measured in various ways, without sacrificing the possiblity of allowing local choice. Feldstein develops a theoretical model to produce a means of achieving "wealth neutrality," i.e., a condition where total spending per pupil by a district will not be related to a measure of local wealth that emphasis property value, income and other variables. At the same time, any desired level of spending by districts can be achieved using the techniques he illustrates, he claims. Feldstein suggests that important elements missing from his analysis are measures of the price and quality of educational services -- a point also made in effect by Ladd.[5]

Still another examination of school district spending -- again using essentially the same Massachusetts data base as Ladd and Feldstein -- is that of Grubb and Michelson.[6] Although Grubb and Michelson's publication date preceeds that of Ladd and Feldstein, the work appears to have taken place at about the same time. Grubb and Michelson's discussion of the impact of different formulations of aid equations is more thorough in attempting to predict the direction of the effect of various factors. For example, they indicate that the effects of an increase in the state aid price variable may be unpredictable or ambiguous from an economic theory standpoint. That is, spending out of locally raised

funds may go up or down for districts facing higher prices of aid, i.e., a lower state matching rate. Through different formulations and varying statistical techniques, Grubb and Michelson estimate a variety of impacts of the price and other variables.

Many other writers have begun to examine the complexities of how school districts behave in response to how state aid formulas and local economic and social factors. Most have not examined explicity change over time. Basically a cross-section approach is utilized, i.e., a look at fiscal behavior across school districts for one particular year. A major question before both policy makers and policy analysts is how might school district behave given a change in aid formulas. Given the problems of data availability, it is very difficult to develop any better answers than what these authors have given. But below, an attempt is made to examine data for two states on a "before" and "after" basis. Data are assembled for two states that have undergone some degree of change, one where a state has in fact greatly changed its basic aid formula from a foundation type to a modified guaranteed tax base type.

A major question is how similar the results would be for states other than Massachusetts in more recent years. Although other writers not discussed here have analyzed school district fiscal behavior in other states to some extent, the recognized basic works are mainly the above. But do other states operate in the same manner? And can the basic elements of state aid formulas be generalized to fit the frameworks developed by these authors?

In an attempt to test the work of previous authors and extend their efforts to more recent data sets and other states, two states were chosen for detailed data collection and analysis -- Colorado (data for fiscal (calendar) years 1973 and 1975) and Minnesota (data for fiscal years 1972 and 1976). These two states were chosen after a survey of selected states for which the wide range of necessary basic data were available. The primary constraints on selecting states as it turned out were the availability of recent income data -- necessarily based on state income tax returns where school district had been identified -- and property tax base composition data. It would appear that more states are collecting income data by school district these days that have good detailed data on property tax base composition by school district. Also, certain states for which all the necessary data probably were available were already being studied for related purposes under National Institue of Education and foundation grants.

II. FISCAL RESPONSES IN COLORADO AND MINNESOTA

As implied above, "fiscal response" relates to district expenditure behavior in response to variations in both internal and external fiscal factors affecting the district. Internal factors include the district's own financial/economic characteristics and external factors include amounts of and conditions on aid receipts from state and federal governments. In addition, there are other constraints increasingly being imposed on districts by state and federal governments that may complicate greatly an analysis of theoretical and actual behavior. Both Colorado and Minnesota have imposed variations of local expenditure and tax limitations. Particularly in the case of Colorado, this makes the statistical analysis very difficult to formulate in order that such conditions are fully and correctly taken into account. In fact, the results of the analysis of the "price variable" for Colorado do not conform well with basic

expectations and the results of others.

The following discussion of the statistical results for Colorado and Minnesota is based mainly on the equations that are described in detail in the Appendix. Various sets of variables are discussed in turn. Both the direct dollar and the elasticity coefficients for the two states are compared.

Both Colorado and Minnesota have undergone reform in the past few years. After the initial change, the elements of the two formulas have been modified, usually to provide even more aid to districts. Whether the changes have been sufficient to withstand state court tests -- one being underway at present in Colorado -- as to sufficient degrees of equity are questions that remain.

In any case, the two states provide interesting cases for testing school district responses to important formula changes. The Colorado case in particular presents a challenge for formulating a price or variable cost sharing component to compare with the results of other writers discussed in Section I. The next section and its supporting appendix addresses this and related issues of fiscal response.

Income

The measure of income used in the current study is different from that used by the authors cited above. The most recent U.S. Census estimates of median family and unrelated individual income for school districts is for 1969. Thus, most writers have focused on fiscal years close to that date. In the present study, adjusted gross income per return based on state tax return data was employed. This measure was chosen since it is the only income measure produced in a few states for school districts that is reasonably current. Also, although adjusted gross income excludes many types of income included in the Census definition, especially transfer payments like welfare and social security, the "per return" denominator may come fairly close to matching up with "per household" that the Census focuses upon.

The upshot is that analysis of school district behavior relative to average income levels in districts as well as inclusion of an "income factor" in a state aid formula requires year-to-year collection of income data. The easiest way to do this appears to be through the state (or possibly federal) income tax system wherein school district would have to be identified on the income tax form. Of course, since many taxpayers may not have accurate information on the school district in which they reside, a monitoring effort is probably necessary at the state revenue collection department.[7]

Each additional $1 of adjusted gross income per return in a district appears to lead to between $0.01 and $0.04 in additional expenditures per pupil, although there are a couple of instances of negative relationships of income

and spending. Most of the additional expenditure appears to take place out of locally financed funds, although in a guaranteed tax base state with true flexibility in gaining additional state aid upon raising the district property tax rate, it would appear that there would be interaction between the tax rate and the district income level. The latter should lead to greater increases in total spending than in locally financed spending alone. However, Colorado does not fit into this simple framework.

Elasticity estimates range from around 0.1 to 0.4, within the range found by other writers for Massachusetts in 1970.

Residential Property Value

Two aspects of residential property value were examined for Colorado and Minnesota -- average market value of residential property per pupil and the percentage of the total assessed valuation of property in the district that is residential. Economic reasoning suggests that increases in the former will lead to greater expenditures per pupil in a district while increases in the latter will tend to result in decreases in expenditure. The statistical results generally conform to these expectations.

A $1,000 increase in residential market value per pupil appears to lead to between $0 and $8 in additional expenditures per pupil, although one result for Colorado in 1975 suggests there could be a small decline in expenditures. In Table 2, the range of elasticities for total expenditures per pupil is shown as -0.07 to 0.11 with the predominance of results in the positive side. And for locally financed expenditures, the results are stronger in terms of elasticities, the range being from 0.10 to 0.54.

The statistically significant results for the percent residential assessed value variable are all negative. A one percentage point increase in percent residential may lead to a $2 to $4 decrease in expenditures per pupil -- generally out of locally financed funds.

It should be noted that although total residential property per pupil was converted to a market value estimate, it appears to be appropriate to examine the percent residential in assessed value terms. Assessment practices vary widely, both among districts and within districts, in most states despite state government efforts to achieve better conformity of valuations. Thus, in terms of relative share of the local tax burden, one should focus on the share of the assessed valuation rather than market valuation of residential property. On the other hand, voter-taxpayers generally will think in terms of their property tax payments relative to the market values of their dwellings rather than assessed valuations.

State and Federal Aid

Of major interest to many policymakers is how school districts will tend to react to changes in levels of state and federal aid when there are no direct matching provisions. For state equalization aid, the response of Colorado districts in 1973 in total spending is estimated to be a negative $1.40 for each $1.00 of additional aid per pupil. That is, across districts, there appears to be an absolute reduction in not only local taxes, but even in total spending. A more plausible result is that for Minnesota where total spending

per pupil appears to increase by $0.30 to $0.40 for each additional $1.00 of state aid per pupil.

The results for local spending conform to these estimates for total spending. Spending out of local (mainly property) taxes is lower with higher state aid across districts, other factors held constant. Minnesota districts on average use an extra state equalization dollar to reduce local taxes by $0.60 to $0.70. The results for Colorado are much stronger, although so high as to be somewhat suspect.

For state categorical aid, the results for the two states are much more similar. A $1.00 increase in categorical aid across districts in both years examined for both states results in between approximately $1.10 and $1.60 in additional total spending. The results of the separate examination of locally financed expenditures conforms to these observations. The components of categorical aid vary between the two states and for the two years, of course, ranging from additional aid for disadvantaged children to aid for transportation services.

The results for federal aid of all types generally parallel those for state categorical aid. For the most part, the effect on expenditures is stimulative, except for Minnesota in 1976. The impacts for all cases but the latter appear to be an increase in total spending of from $1.10 to $1.70 for an additional $1.00 of federal aid. In Minnesota for 1976, the increase in spending is more on the order of $0.90, i.e., there may be some substitution, in effect, of federal dollars for local dollars, but this is a tenuous conclusion given that the locally financed expenditures equation did not indicate a statistically significant effect of federal aid for Minnesota in 1976 and given the positive elasticity coefficient (See below).

Responses of total expenditures to one percent increases in state equalization aid and state categorical aid ranges form -0.15 to 0.15 percent. These estimates are only slightly outside the range found for Massachusetts by Ladd and Feldstein. The largest local expenditures decrease, -0.40,, was greater (in absolute value) than found by Grubb and Michelson. The percent response to federal aid, 0.02 to 0.11, was within the range obtained by Ladd and Feldstein. Grubb and Michelson's local expenditure response was much larger than found for Colorado and Minnesota in the present study.

One further note may be added here. Due to difficulties with the specification and results for the "price" of state equalization aid variable for Colorado in 1975, a further statistical test was made based on the differences in expenditures and in various explanatory variables between 1973 and 1975 (i.e., 1975 values less 1973 values). This approach gives a type of longitudinal ("over time") view of how districts may react to changes in fiscal variables than the purely cross section ("point in time") approach discussed above and used by most writers. The results from this approach (shown in Appendix Tables A-9 and A-10) suggest that in Colorado, there may indeed be substitution of state categorical aid for locally financed expenditures; that is, local property taxes are reduced -- at least beyond what they otherwise would have been -- with additional aid for specific purposes. In the case of federal aid, there appears to be a clear stimulation of additional local spending taking this approach.

Fiscal Price

There are alternative ways to conceive of the potential effects of a guaranteed tax base type of state equalization aid formula as discussed in Section I above. In any case, a guaranteed tax base will mean that at least for those districts with property values per pupil below the guarantee level, an extra dollar of total spending per pupil will mean less than one dollar of additional local taxes. Thus, there is a sharing of additional expenditures between the state government and the district.

Although there are variations, most writers have specified what is called here the "fiscal price" in terms of a ratio. That ratio is often local expenditures (revenues) divided by the sum of state equalization aid through the guaranteed tax base formula and the locally-financed expenditures. Thus, this "price" or sharing ratio will range in theory from zero (no local contribution) to one (no state equalization aid through the GTB formula).

Basically, this is the type of fiscal price variable in operation in Colorado. However, several additional constraints have been added to the simple guaranteed tax base formula. There are actually two groups of districts, those above and those below the so-called "minimum guarantee." In the former case, the basic ratio of local to local plus state equalization expenditures in a district is a direct function of total assessed value of property per pupil in the district. For the latter group, the basic formula turns out to be a more complicated function of assessed value of property per pupil in the district (total assessed value per pupil divided by the sum of total assessed value per pupil and $9,000).

A further complication that makes statistical estimation of fiscal price effects very difficult is the imposition of expenditure growth limitations. Furthermore, if a district were allowed to increase its authorized revenue base beyond the given percentage restriction, all the additional expenditures had to come from local taxes. However, this additional spending above the basic increase became incorporated in the next year's authorized revenue base and thus was subject to sharing in state aid in the usual manner of the basic guarantee in the succeeding year.

In effect, this latter variation in the effective fiscal price from one year to the next suggests that district decision-makers might be willing to pay a high price for additional expenditures this year knowing that they will get back to a lower price next year. In any case, the fiscal price variable in Colorado as specified in the statistical equation for the present study exhibited a strongly positive effect on expenditures rather than the otherwise predicted negative relationship.

A 0.1 increase in the fiscal price, which ranges between 0.13 and 0.92 for 1975, leads to an increase in total expenditures per pupil on average between $68 (Group A -- assessed value of property per pupil below $18,000) and $332 (Group B -- assessed value of property above $18,000). The similar range for locally-financed expenditures is $129 to $423. That the locally-financed increase is larger than the total increase suggests that districts may be spending out of own funds after obtaining permission for an authorized revenue base increase while anticipating the state's sharing in this increase in the succeeding year.

The elasticity estimates are similarly positive and statistically significant. The impact of the price difference is quite a bit higher for the high-wealth districts.

As discussed at the end of the previous subsection, a further attempt to isolate a fiscal price effect of the "correct" sign was made through differencing 1975 and 1973 expenditures and explanatory variables. The fiscal price of additional expenditures in 1973 was effectively 1.00, since "extra" total expenditures beyond the given foundation aid level were financed entirely by local revenues. Thus, this price fell from 1973 to 1975 for all districts.

The statistical results conform slightly better to the simple a priori analysis. For the lower property value districts, the statistical coefficient is of the correct sign where a larger decrease in price indicates a larger increase in total expenditures; but the coefficient is not statistically significant. In the other instances -- the higher property value districts and for locally financed expenditures -- the coefficients are much lower than from the cross-section analysis, but still of the wrong sign.

In sum, it is difficult to establish relationships for the fiscal price variable in Colorado that conform to the simple theoretical prediction and the statistical results for Massachusetts in 1970. However, the existence of expenditure constraints that can be varied upon petition and result in sharing in succeeding years, but not the current year, complicate greatly the simple analysis and statistical interpretation and testing. Hence, it would have been difficult to predict the fiscal responses of school districts in Colorado in moving to the new formula after 1973 when so many side conditions were imposed.

Other Variables Examined

A variety of other potential explanatory factors in addition to those discussed above were examined, as can be seen in Appendix Tables A-1 through A-10. These variables were examined for their own sakes and to standardize for a variety of factors thought to affect school district spending. These include: the pupil growth rate during the time period analyzed; pupil density; district size in terms of pupils; "dummy" variables included as attempts to capture the effects of revenue limits and override attempts; percent minority pupils; districts per square mile in the district's region (an attempt to get at competition for teachers); price of agricultural land and highest teacher salary (Colorado only) (an attempt to get a crude measure of education cost variations across districts). Some of the results for these variables will be summarized briefly here.

Pupil growth appears to have a positive impact on expenditures per pupil in most instances. This result is contrary to the argument that declining enrollments have tended to increase expenditures per pupil due to lags in ability to adjust total expenditures. However, both states have special

programs to aid high growth and/or decline districts, which can distort the underlying patterns.

Higher pupil density generally has an increasing effect on expenditures. The pupil size variables, including the square of pupil size, are included in an attempt to take some account of possible economies or diseconomies of scale. The results suggest that rather than the normally conceived "U-shaped" cost curve where average costs may fall to a minimum at some size and rise thereafter, this crude attempt to capture a size relationship suggests that average costs might rise steadily beyond the size of even the largest school district in both states.

The dummy variables inserted in an attempt to allow for limitations and overrides do have statistically significant effects for both states. The major goal for including these was to get the desired negative sign for the fiscal price variable. Although the desired result was not fully achieved, the impact of these variables was in the correct direction, reducing the importance of the positive fiscal price relationship in Colorado.

Percent minority pupils has mixed effects in the regression equations. In the earlier years in both states, the effect on expenditures was negative, while it tended to be positive in the later years.

The last three variables examined, districts per square mile in the region of the district, the average price of agricultural land in the region of the district and the highest teacher salary, show both positive and negative, statistical significance and insignificance, in different equations. Either sign for a cost index is reasonable since districts may exhibit either elastic or inelastic demand for education services with respect to price of inputs, which respectively, can lead to either decreased or increased expenditures per pupil with cost increases.[8]

III. CONCLUSIONS AND POLICY IMPLICATIONS

The results of the above analysis hopefully are interesting both for what they indicate and what they do not resolve. For example, it is likely that school districts will tend to use at least some general aid to reduce locally funded spending, i.e., reduce local property taxes, if this is permitted. In fact, even if the legislative intent is full use of additional aid for education spending, district decision-makers often will have ways of circumventing this policy unless there are very tight restrictions. Thus, school finance aid increases can generally be counted upon as effecting some property tax relief, one of the often-stated goals of school finance reform, in addition to or even considered more important than equalization of expenditures or greater fiscal neutrality.

On the other hand, the frustrating results for the fiscal price variable suggest that more work needs to be done to understand just how guaranteed tax base programs operate in practice across the states. The Colorado case can be looked at in perhaps two ways: (1) further work must be done in formulating the statistical relationships so that the "correct" negative relationship of total spending per pupil and fiscal price is demonstrated, vs.(2) in reality, there is no true fiscal price in operation in Colorado -- and many other GTB states -- that allows districts to choose their levels of expenditure along a path that is fiscally neutral at least with respect to property value per pupil alone. The latter point can be extended to argue that we perhaps need to investigate the various rationales for the restrictions imposed by legislatures and the variety ways in which they are carried out.[9]

The direct technical uses of the results of fiscal response analysis will be discussed in turn. Some thoughts on other issues that are relevant are summarized in a concluding subsection.

Modifications in State General Aid Formulas

The concept of fiscal neutrality has received much attention in the school finance literature of late. The initial concept may have been focused primarily on children, but it has come to be associated more with a type of equal treatment of property taxpayers across school districts.[10] Various writers have pointed out that if a simple standard of property-wealth-per-pupil neutrality is utilized in a state aid formula, i.e., a simple sharing or guaranteed tax base formula, then school districts' expenditures per pupil will tend to vary widely across a state. A basic reason for this is that factors other than assessed value of property per pupil will influence school district spending, a point that is demonstrated in the statistical analysis in this report.[11] Hence, even if a state guarantees completely equal effective property tax bases to all districts in the state, a low average income district will tend to spend less (choose a lower property tax rate) than a high average income district. Thus, legislators may wish to neutralize for other elements of fiscal capacity than simply the direct local tax base, assessed value of property.

The following will illustrate in a rather simplified manner how additional fiscal variables and the coefficients developed from statistical analysis as presented earlier might be used to neutralize for such other factors. The present example will simply focus on the income relationship, i.e., development of a so-called "income factor" in a aid formula, to illustrate the procedure. A more complete, though complicated, approach is demonstrated by Feldstein.

For purposes of illustration, assume that the equations in the Appendix can be reduced to the following elementary form:

Total Expenditures per Pupil =

A + B x Income per Return + C x State Aid per Pupil.

We can then set a hypothetical goal that every district in the state should be able to spend equal amounts per pupil, if they choose to do so. We can then consider any two districts, call them District 1 and District 2, and assume that they make equal expenditures per pupil (have equal Total Expenditures Per Pupil). What state aid differentials could make up for the actual income differentials of these two districts?

We can write out our assumption ("goal") of equal revenues per pupil and then do a little algebraic manipulation to come up with a simple income factor for modifying state aid.

Total Expenditures per Pupil in District 1 = Total Expenditures per Pupil in District 2

Then substituting on each side for the explanatory equation written above, using the actual levels of income in each district and using the desired level of aid for each district to neutralize for the income differences, we can write:

A + B x Total State Aid per pupil in District 1 + C x Income per Return in District 1 =

A + B x Total State Aid per pupil in District 2 + C x Income per Return in District 2

This equation can be solved for the "aid differential" to yield:

(Total State Aid per pupil in District 1 - Total State Aid per pupil in District 2) = (C + B) x (Income per Return in District 2 - Income per Return in District 1)

That is, the "income factor" in this case is (C + B), the regression coefficient for income per return divided by the regression coefficient for state aid per pupil in explaining expenditures per pupil.

This result is used in the following manner to get aid differential results for each district in the state. Take District 1 income per return to be the state average across districts. Then District 2 is any particular district in the state. If District 2 has an income per return below the state average, then the income differential is negative. Multiplying this differential by (C ÷ B), which is positive, yields a negative value for the hypothetical difference between state aid in the first district (the "average district") and the second, below-average-income district. But this means that the second district should get this much more aid per pupil than the hypothetical average district. The aid differential in the above equation could be positive, but this is interpreted as meaning that this much aid per pupil would be taken out of the aid calculated normally for an above-average-income district on the basis of district property value per pupil.

To illustrate specifically, we can borrow from the results for Minnesota in 1976 (see Table A-2) where the income response coefficient is $0.029 and the state equalization aid response coefficient is $0.280. Dividing the former by the latter yields a factor of 0.104. This factor times the difference in average district income from, say, the state average income, would yield an increase or decrease in aid per pupil to be applied to normally calculated district aid.

It must be emphasized that the above calculation has been done for illustrative purposes only as the case presented applies more strictly to a state with a foundation type of aid formula where an additional income factor might be desired. A more extensive calculation based on the fiscal price variable relationships would be necessary in a true guaranteed tax base formula. Again, the interested reader is referred to the rather technical discussion in Feldstein. In any case, similar calculations can be made for any one or a

combination of the various fiscal variables explored in this report, including market value of residential property per pupil and percent residential assessed value.

In concept, "all" socioeconomic and demographic factors that explain expenditures per pupil could be incorporated in an adjustment of the state aid formula, although most formal discussions have tended to focus on the economic variables thought to comprise "fiscal capacity"; elements such as cost differentials and declining enrollments could be compensated for in other direct or indirect ways.[12] However, if the real goal is to achieve near equality in expenditures per pupil, perhaps adjusted for differential costs, pupil need, etc., then a direct approach by the state would be technically ever so much simpler than highly complicated adjustments to an aid formula while attempting to continue what some refer to a "local fiscal control."

Local fiscal control can run a spectrum from belief that the state should play very little role in adjusting for local fiscal capacity or expenditure differences, to belief that fiscal capacity should be greatly equalized along several measures including income and tax base composition as well as assessed value. But most of those advocating local expenditure control would agree that local tastes, unconfined by local fiscal capacity, should still determine variations in expenditures per pupil.

Again, if expenditure equality is the real goal, it can be achieved in a technical fashion much more directly. The politics of achieving this goal may be another matter, since there may remain divergent opinion over the appropriateness of this goal.[13]

Longer-run Issues

One of the more complex issues of school finance reform, including especially major changes in school aid formulas aid allocations of aid to different districts, is the long-run adjustments in locations of firms and individuals and accompanying property demand. Some of the measures of district fiscal capacity that are analyzed here for their impacts on fiscal responses will

themselves change over time in response not only to basic economic and social forces, but also to changes in the aid formulas themselves. In property value terms, to put it another way, increases and decreases in local property taxes together with increases and decreases in school spending will tend to be "capitalized."

To illustrate, assume that a new school aid formula is introduced that neutralizes fiscal capacity both for property value per pupil differences and income differences among school districts. In addition, assume there is a recapture and/or expenditure limitation provision that forces very high spending districts to cut back on school services. The forces from both the tax side and the expenditure side on a school district that initially is fortunate enough to have both high property value per pupil and high income per family (in most states these are not highly correlated) would be such as to reduce property values in the district. A reform of this nature will tend to raise property taxes in the high wealth district -- or at least reduce them in adjacent low-wealth districts. Thus, one attractive element of the high-wealth district will be reduced and competitive forces will tend to reduce the price of housing in this district. Similarly, a reduction of government services -- here from the very important education sector -- with no accompanying property tax reduction will tend to reduce the value of the home in the high-wealth district in comparison with a home in another school district that retains the same characteristics (e.g., size, convenience, view), except for the modified flow of services. The numerical values of these changes and the time period over which they take place are very difficult to sort out, but the direction of the effect is rather clear.[14]

Changes in demand for property in alternative districts can also arise through the addition of the income factor. The advantages of living in a

higher income community for those who desire greater education spending, in this example, will also be reduced. There are usually homeowners "on the margin" who chose this district over another because of its advantages in terms of education taxing and spending and who will now consider moving to another location if these advantages disappear.

Overall, this process will take a long time. And the school aid formula, if it really is allowed to operate without important "grandfather clauses" or expenditures and tax restrictions, will continually reallocate aid flows from year to year in part in response to these changes in property values, average income levels and other relevant variables induced by the initial reform. It likely will be a few years before a new relatively settled (equilibrium) situation is reached, particularly if this reform is a major one.

Inman is one author who explicitly speculates on the impacts that reform of school finance formulas may have on some of the above fiscal variables themselves.[15] In a rather complicated general equilibrium framework of economic theory, he considers how a fuller analysis would include the costs of locally producing education, household and business location decisions, impacts on land values and further responses of school districts to changes in such variables. It is difficult to determine just how these changes will work themselves out except in a general theoretical way.

For purposes of the present type of fiscal analysis, this suggests that the relationships of district education spending to the various economic and demographic variables examined will probably change over time with important school finance reforms. Hence, if the coefficients from the estimated behavioral relationships are themselves influencing the aid formula, there will be a feedback process in operation.

The formula may have to be modified from time to time to take into account these new relationships, although the numerical levels of the coefficient changes may turn out to be so small as to make this a minor empirical issues.

Final Conclusions

Despite the difficulties in sorting out the intricies of fiscal responses of school districts, some conclusions are becoming relatively clear. In the states examined, school district decision-makers on average opt for reducing local property taxes around fifty cents or more on the dollar of additional state aid when they are free to do so. Hence, reform that gives more general aid to most all districts will result in property tax relief as well as increased school spending. It is likely that somewhat more tax reduction will take place in communities that are poorer in both property value per pupil and average income. On the other hand, state and federal categorical aid have tended to have stimulative effects on total spending, although perhaps more because of required local effort than local free choice.

On the other hand, it is extremely difficult to throw much light on the effect of an unrestrained "fiscal price variable" response -- in Colorado and many other states, such local choice does not really exist. In fact, the 1975 Colorado case may be more representative of present and future school finance reforms than is the 1970 Massachusetts case.

Average income of the district's residents as well as property wealth does make a difference. In fact, market value of housing per pupil is an important variable that may reflect more of families' "permanent" income than yearly actual income levels. Likewise the percentage of property value that is residential does have a negative influence on spending, probably reflecting

the reduced actual and perceived ability of voter-taxpayers to shift property tax burdens to locally based businesses and nonresidents.

The future direction of work involves both better specification of the underlying behavioral equations, including perhaps the addition of both short-run and long-run interactions with other sectors of the economy. And better expenditure model results are likely to occur when we have estimates available for the costs of producing education services across districts in a state.[16]

APPENDIX

STATISTICAL EQUATIONS AND DATA SOURCES

The theoretical developments and statistical procedures utilized by economists analyzing fiscal responses of school districts have grown complex indeed. In the analysis presented here, the work of other writers is built upon, but relatively simple statistical techniques are used. However, these techniques may appear mysterious indeed to the layman who is not very familiar with formal statistical analysis.

Although the underlying mathematics and computer manipulations involved in "multiple regression analysis," the statistical approach employed here, are complex, the basic interpretation of the resulting equations can be relatively straight forward.

A basic rationale of formal statistical procedures as used here is to sort out apparent relationships of different factors, to sort out those associations that are more by chance from those where there may be true causal relationships. We would also like to know something about the orders of magnitude of these relationships that appears to be other than by chance.

Statistical Equations

Tables A-1 through A-10 present the basic equations upon which the discussion in Section III is based. The equations are alternative formulations of the relationships between total or locally financed educational spending per pupil by essentially all districts in each of the two states. Tables A-1 and A-2 indicate the relationships found for total spending per pupil in the two states and Tables A-3 and A-4 are for spending out of local revenues, almost entirely from property taxes. These first four sets of equations are

TABLE A-1

TOTAL CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO, 1973 AND 1975 -- LINEAR EQUATION FORM[a]

Variables	1973	1975	
		Group A	Group B
Constant Term ($/pupil)	991.069	455.716	[999.999]
State Equalization Aid ($/pupil)	-1.383 (5.447)	---	---
Price Variable	---	682.573 (3.579)	3318.361 (5.663)
State Categorical Aid ($/pupil)	1.601 (7.352)	1.053 (6.918)	1.591 (9.935)
Federal Aid ($/pupil)	1.682 (12.842)	1.065 (4.992)	0.174 (0.301)
Residential Market Value ($/pupil)	0.003 (5.316)	-0.003 (1.465)	0.000 (0.184)
Percent Residential Assessed Value	-4.117 (4.161)	1.073 (0.628)	-1.729 (0.863)
Adjusted Gross Income ($/return)	0.014 (1.233)	-0.001 (0.106)	0.016 (1.030)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	353.138 (2.733)	200.770 (2.082)	535.939 (1.875)
Density (pupils/square mile)	1.219 (0.822)	1.043 (0.976)	6.711 (1.625)
Pupils (1000s)	14.421 (1.956)	0.734 (0.137)	8.613 (0.374)
Pupils Squared (1,000,000s)	-0.165 (1.449)	-0.010 (0.138)	[0.000] (0.004)
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	---	107.657 (2.977)	183.987 (2.343)
Percent Minority Pupils	-2.522 (2.637)	-0.675 (9.819)	0.826 (0.387)
Districts Per Square Mile in Region (1000s)	29.660 (2.773)	0.868 (0.104)	28.706 (1.272)
Price of Agricultural Land ($/acre)	0.029 (0.656)	0.195 (1.561)	-0.056 (0.373)
Highest Teacher Salary ($)	-0.023 (2.066)	0.002 (0.221)	-0.026 (1.220)
R^2	0.83	0.69	0.85

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-2

TOTAL CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR MINNESOTA, 1972 AND 1976 -- LINEAR EQUATION FORM[a]

Variables	1972	1976
Constant Term ($/pupil)	359.751	660.394
State Equalization Aid ($/pupil)	0.411 (4.878)	0.280 (3.893)
State Categorical Aid ($/pupil)	1.325 (14.571)	1.068 (16.283)
Federal Aid ($/pupil)	1.301 (9.701)	0.887 (10.074
Residential Market Value ($/pupil)	0.007 (3.742)	0.001 (0.940)
Percent Residential Assessed Value	-4.054 (5.280)	-2.131 (2.197)
Adjusted Gross Income ($/return)	0.043 (5.230)	0.029 (5.261)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	14.001 (0.238)	25.843 (0.412)
Density (pupils/square mile)	0.169 (3.100)	0.314 (4.703)
Pupils (1000s)	6.692 (1.746)	5.503 (1.134)
Pupils Squared (1,000,000s)	-0.125 (1.768)	-0.067 (0.614)
Voter Override Attempted, 1973-76 (dummy variable: 1-yes; 0-no)	---	34.050 (1.944)
Percent Minority Pupils	-3.677 (3.223)	2.492 (1.812)
Districts Per Square Mile in Region (1000s)	-9.337 (4.072)	-8.028 (3.128)
Price of Agricultural Land ($/acre)	-0.010 (0.261)	0.017 (0.679)
R^2	0.50	0.66

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-3

LOCALLY FINANCED CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO, 1973 AND 1975 -- LINEAR EQUATION FORM[a]

Variables	1973	1975	
		Group A	Group B
Constant Term ($/pupil)	991.979	-291.407	[999.999]
State Equalization Aid ($/pupil)	-2.382 (9.382)	---	---
Price Variable	---	1291.504 (11.828)	4233.813 (8.392)
State Categorical Aid ($/pupil)	0.601 (2.762)	0.157 (1.802)	0.543 (3.937)
Federal Aid ($/pupil)	0.682 (5.206)	0.080 (0.605)	-0.770 (1.551)
Residential Market Value ($/pupil)	0.003 (5.316)	-0.001 (0.964)	0.111 (0.235)
Percent Residential Assessed Value	-4.119 (4.164)	14.875 (0.152)	-146.136 (0.847)
Adjusted Gross Income ($/return)	0.014 (1.230)	0.001 (0.103)	0.014 (1.014)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	352.672 (2.729)	119.648 (2.167)	520.397 (2.115)
Density (pupils/square mile)	1.213 (0.818)	0.507 (0.828)	4.638 (1.304)
Pupils (1000s)	14.436 (1.958)	0.110 (3.064)	6.743 (0.340)
Pupils Squared (1,000,000s)	-0.166 (1.453)	-0.001 (0.013)	[0.000] (0.000)
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	---	53.706 (2.594)	155.903 (2.305)
Percent Minority Pupils	-2.523 (2.639)	-0.324 (0.376)	1.054 (1.342)
Districts Per Square Mile in Region (1000s)	29.700 (2.776)	-1.806 (0.376)	26.088 (1.342)
Price of Agricultural Land ($/acre)	0.029 (0.660)	0.148 (2.062)	-0.042 (0.326)
Highest Teacher Salary ($)	-0.023 (2.070)	0.003 (0.671)	-0.108 (0.987)
R^2	0.79	0.86	0.77

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-4

LOCALLY FINANCED CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR MINNESOTA, 1972 AND 1976 -- LINEAR EQUATION FORM[a]

Variables	1972	1976
Constant Term ($/pupil)	352.618	657.931
State Equalization Aid ($/pupil)	-0.551 (6.546)	-0.720 (10.008)
State Categorical Aid ($/pupil)	0.306 (3.376)	0.065 (0.995)
Federal Aid ($/pupil)	0.243 (1.819)	-0.094 (1.068)
Residential Market Value ($/pupil)	0.007 (4.068)	0.001 (0.951)
Percent Residential Assessed Value	-4.469 (5.848)	-2.120 (2.185)
Adjusted Gross Income ($/return)	0.044 (5.347)	0.029 (5.282)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	12.370 (0.212)	25.963 (0.414)
Density (pupils/square mile)	0.170 (3.120)	0.313 (4.690)
Pupils (1000s)	7.002 (1.836)	5.491 (1.132)
Pupils Squared (1,000,000s)	-0.133 (1.889)	-0.068 (0.627)
Voter Override Attempted 1973-76 (dummy variable: 1-yes; 0-no)	---	33.791 (1.929)
Percent Minority Pupils	-2.254 (1.985)	2.463 (1.791)
Districts Per Square Mile in Region (1000s)	-9.106 (3.991)	-8.007 (3.119)
Price of Agricultural Land ($/acre)	-0.009 (0.254)	0.017 (0.690)
R^2	0.47	0.63

[a] t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-5

TOTAL CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO, 1973 AND 1975 -- LOG LINEAR (ELASTICITY) EQUATION FORM[a]

Variables	1973	1975	
		Group A	Group B
Constant Term ($/pupil)	4.546	4.857	1.142
State Equalization Aid ($/pupil)	-0.149 (3.581)	---	---
Price Variable	---	0.163 (2.007)	1.234 (4.629)
State Categorical Aid ($/pupil)	0.092 (3.979)	0.096 (5.740)	0.106 (4.218)
Federal Aid ($/pupil)	0.036 (4.213)	0.032 (3.244)	0.015 (1.467)
Residential Market Value ($/pupil)	0.111 (4.274)	-0.044 (0.742)	0.056 (1.410)
Percent Residential Assessed Value	-0.144 (4.424)	0.038 (0.642)	-0.074 (1.423)
Adjusted Gross Income ($/return)	-0.040 (0.797)	-0.057 (0.736)	-0.030 (0.522)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	0.283 (2.472)	0.082 (0.747)	0.270 (1.693)
Density (pupils/square mile)	0.031 (2.055)	0.014 (1.159)	0.057 (2.445)
Pupils (1000s)	-0.079 (3.405)	-0.071 (3.526)	-0.210 (5.102)
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	---	0.063 (2.076)	0.054 (1.139)
Percent Minority Pupils	-0.002 (3.284)	-0.000 (0.201)	-0.000 (0.316
Districts Per Square Mile in Region (1000s)	0.045 (1.656)	0.032 (1.317)	0.102 (2.483)
Price of Agricultural Land ($/acre)	0.040 (1.767)	0.045 (1.859)	0.051 (1.678)
Highest Teacher Salary ($)	0.179 (0.119)	0.274 (2.710)	0.557 (2.964)
R^2	0.76	0.58	0.77

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-6

TOTAL CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR MINNESOTA, 1972 AND 1976 -- LOG LINEAR (ELASTICITY) EQUATION FORM[a]

Variables	1972	1976
Constant Term ($/pupil)	2.139	5.533
State Equalization Aid ($/pupil)	0.130 (3.230)	-0.029 (1.602)
State Categorical Aid ($/pupil)	0.150 (10.873)	0.143 (9.676)
Federal Aid ($/pupil)	0.110 (8.177)	0.088 (7.321)
Residential Market Value ($/pupil)	0.045 (1.929)	-0.065 (3.733)
Percent Residential Assessed Value	-0.088 (3.956)	0.005 (0.318)
Adjusted Gross Income ($/return)	0.286 (5.365)	0.168 (5.151)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	0.053 (0.929)	-0.042 (0.925)
Density (pupils/square mile)	0.033 (3.497)	0.040 (5.262)
Pupils (1000s)	-0.024 (2.270)	-0.003 (0.327)
Voter Override Attempted, 1973-76 (dummy variable: 1-yes; 0-no)	---	0.022 (1.738)
Percent Minority Pupils	0.003 (2.495)	0.004 (4.486)
Districts Per Square Mile in Region (1000s)	-0.037 (1.755)	-0.056 (3.286)
Price of Agricultural Land ($/acre)	-0.044 (2.096)	-0.023 (1.361)
R^2	0.42	0.51

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-7

LOCALLY FINANCED CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO -- LOG LINEAR (ELASTICITY) EQUATION FORM[a]

Variables	1973	1975	
		Group A	Group B
Constant Term ($/pupil)	1.536	4.662	2.684
State Equalization Aid ($/pupil)	-0.348 (5.540)	---	---
Price Variable	---	1.075 (11.948)	2.210 (7.902)
State Categorical Aid ($/pupil)	0.078 (2.244)	0.048 (2.594)	0.032 (1.215)
Federal Aid ($/pupil)	-0.008 (0.006)	0.005 (0.500)	-0.004 (0.386)
Residential Market Value ($/pupil)	0.256 (6.584)	-0.019 (0.287)	0.098 (2.349)
Percent Residential Assessed Value	-0.300 (6.122)	0.005 (0.077)	-0.129 (2.369)
Adjusted Gross Income ($/return)	0.111 (1.469)	0.022 (0.256)	-0.032 (0.527)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	0.412 (2.390)	0.235 (1.340)	0.408 (2.436)
Density (pupils/square mile)	0.039 (1.750)	0.022 (1.652)	0.066 (2.691)
Pupils (1000s)	-0.074 (2.122)	-0.042 (1.893)	-0.160 (3.710)
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	---	0.102 (3.015)	0.106 (2.139)
Percent Minority Pupils	-0.006 (4.900)	-0.000 (0.420)	0.000 (0.002)
Districts Per Square Mile in Region (1000s)	0.016 (0.391)	0.002 (0.073)	0.062 (1.434)
Price of Agricultural Land ($/acre)	0.064 (1.881)	0.066 (2.482)	0.044 (1.392)
Highest Teacher Salary ($)	0.255 (1.421)	0.192 (1.711)	0.376 (1.907)
R^2	0.81	0.92	0.78

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-8

LOCALLY FINANCED CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR MINNESOTA, 1972 AND 1976 -- LOG LINEAR (ELASTICITY) EQUATION FORM[a]

Variables	1972	1976
Constant Term ($/pupil)	-0.092	-1.445
State Equalization Aid ($/pupil)	-0.402 (3.291)	-0.313 (5.183)
State Categorical Aid ($/pupil)	0.047 (1.132)	0.018 (0.372)
Federal Aid ($/pupil)	0.072 (1.758)	0.061 (1.518)
Residential Market Value ($/pupil)	0.461 (6.440)	0.542 (9.363)
Percent Residential Assessed Value	-0.486 (7.176)	-0.540 (9.505)
Adjusted Gross Income ($/return)	0.408 (2.518)	0.302 (2.782)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year	-0.042 (0.247)	-0.203 (1.342)
Density (pupils/square mile)	0.060 (2.098)	0.081 (3.151)
Pupils (1000s)	-0.034 (1.080)	0.013 (0.477)
Voter Override Attempted 1972-75 (dummy variable: 1-yes; 0-no)	---	0.104 (2.463)
Percent Minority Pupils	-0.012 (3.579)	0.004 (1.374)
Districts Per Square Mile in Region (1000s)	-0.092 (1.431)	-0.133 (2.341)
Price of Agricultural Land ($/acre)	-0.110 (1.722)	0.041 (0.729)
R^2	0.51	0.63

[a] t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-9

CHANGE IN TOTAL CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO, 1975 LESS 1973 -- LINEAR EQUATION FORM[a]

Variables	1975-1973	
	Group A	Group B
Constant Term ($/pupil)	206.950	862.206
Price Variable	-47.338 (0.670)	688.166 (1.652)
State Categorical Aid ($/pupil)	0.533 (5.331)	0.981 (5.438)
Federal Aid ($/pupil)	1.605 (7.935)	1.579 (7.641)
Residential Market Value ($/pupil)	0.002 (1.159)	-0.000 (0.437)
Adjusted Gross Income ($/return)	-0.018 (1.503)	-0.003 (0.132)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	-45.856 (0.768)	-539.268 (2.503)
Density (pupils/square mile)	-6.697 (0.983)	-2.429 (0.101)
Pupils (1000s)	-9.704 (0.531)	4.918 (0.142)
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	106.075 (4.778)	189.640 (3.722)
Percent Minority Pupils	5.925 (1.708)	6.845 (0.798)
Highest Teacher Salary ($)	-0.013 (1.931)	-0.010 (0.326)
R^2	0.56	0.65

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicated sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

TABLE A-10

CHANGE IN LOCALLY FINANCED CURRENT EXPENDITURES PER PUPIL FISCAL RESPONSE COEFFICIENTS FOR COLORADO, 1975 LESS 1973 -- LINEAR EQUATION FORM[a]

Variables	1975-1973	
	Group A	Group B
Constant Term ($/pupil)	86.865	932.939
Price Variable	116.918 (1.486)	812.993 (2.211)
State Categorical Aid ($/pupil)	0.013 (0.118)	-0.127 (0.797)
Federal Aid ($/pupil)	0.333 (1.480)	0.332 (1.821)
Residential Market Value ($/pupil)	0.008 (4.224)	0.000 (0.817)
Adjusted Gross Income ($/return)	0.006 (0.431)	-0.012 (0.672)
Pupil Growth Ratio (pupils in 2nd year/ pupils in 1st year)	-101.788 (1.531)	-756.591 (3.980)
Density (pupils/square mile)	2.766 (0.364)	18.279 (0.860)
Pupils (1000s)	-10.860 (0.534)	-17.949 (0.585)
Pupils Squared (1,000,000s)		
Allowed Expenditure Limit Increases (dummy variable: 1-yes; 0-no)	45.786 (1.851)	189.153 (4.207)
Percent Minority Pupils	2.503 (0.648)	7.573 (1.001)
Highest Teacher Salary ($)	-0.013 (1.800)	0.013 (0.446)
R^2	0.31	0.58

[a]t-statistics are in parentheses below the regression coefficients. Variables of the predicted sign are statistically significant at the 90 percent level of confidence when the t-statistics are greater than 1.30 and at the 95 percent level when greater than 1.67.

in "linear" form. Thus, the numerical coefficients can be interpreted as in the following example. In Table A-1, the coefficient for Colorado in 1973 for Federal Aid is 1.682 -- and is statistically significant at the 95 percent level of confidence, i.e., we can be fairly sure the true relationship is in the neighborhood of this value. (See the footnotes at the the bottom of each table.) Thus $1 additional federal aid for a school district -- assuming all other influences identified in the equation are the same -- would on average have resulted in an additional $1.68 in total spending by the district. Total federal revenue per pupil for Colorado school districts in 1973 averaged $53. Hence, an "average" school district receiving this average amount of federal aid might have been predicted to have spent an additional $89 per pupil. Thus, additional total spending beyond the grant money appears to have been encouraged. A supporting result is found in Table A-3 for federal aid: a $1 variation in federal aid appears to have lead to a $0.68 increase in locally financed expenditures.

The "constant term" in the equations is rather hypothetical. It suggests the amount that would have been spent by a school district even if the values of all the explanatory variables in the equations were zero.

Tables A-5 through A-8 parallel the previous four tables. However, most of the variables, including the dependent variables, total or locally financed current expenditures per pupil, are in natural logarithm form. Taking the logs of the variables before running the multiple regression results in a different interpretation of the coefficients from the previous straight linear form. The coefficients are now the "elasticities" of response. For example, the result for federal aid for Colorado in 1973 (see Table A-5) suggests that a 1 percent change in federal aid per pupil tends to result in approximately a 0.036 percent change in total spending per pupil. Estimating the equations

in elasticity form can make comparisons across states and across time a bit easier since units of measurement, mean levels of the variables, basic inflationary effects and other factors may not need to be taken into account.

At least one other numerical relationship may need explanation. The "R^2" in the bottom row of each table indicates the percentage of the variation in the dependent variable, expenditures, that is explained by the above explanatory variables that have been included in the equation. Thus, in Table A-1, around 83 percent of the variation in total expenditures per pupil by school districts in Colorado in 1973 could be explained by those factors examined here.

As suggested earlier, there are a variety of analytical problems that remain in formulating some of the variables and their relationships, including especially the price variable for Colorado, and in testing the relationships by more sophisticated statistical techniques. Many of the issues remain to be clarified.

Data Sources

Colorado. For the state of Colorado most of the data used in the analysis were obtained directly from the Department of Education. These data included the following variables: total current expenditures, locally financed current expenditures, state equalization aid, state categorical aid, federal aid, adjusted gross income, pupils, percent minority pupils, square miles of school districts and teacher salary data. "Expenditure" data are actually tax and general aid revenues for current operating expenses; revenue data are generally used in such studies to avoid major difficulties in sorting out accounting procedures on expenditures and to attain greater comparability within and among states. Local tax administrators had provided data directly to the Department on the composition of the district's tax base.

Another large component of the data was provided by the Colorado Department of Property Taxation. These data included: total assessed valuation by district, market value ratios and assessors market value by county. Various assumptions were necessary to allocate property value data to districts lying in more than one county. It became necessary to use 1975 breakdowns only to determine residential versus nonresidential percentages.

Other data were derived from several Census publications. The counties that lie within economic areas (defined by the Census as relatively homogeneous subdivisions of states) are from: U. S. Bureau of the Census, State Economic Areas, 1970 Census of Population, (Washington, D. C.: Government Printing Office, 1970), Appendix A. Square miles of these areas were derived from from U. S. Bureau of the Census, County and City Data Book, 1972 (Washington, D. C.: Government Printing Office, 1972), Table 2, Item 1-15. A final variable, the price of agricultural land, was obtained from U. S. Bureau of the Census, 1974 Census of Agriculture, County Summary Data (Washington, D.C.: Government Printing Office), Table 1.

Minnesota. The data for the state of Minnesota were obtained from several publications and computer tapes provided by the Minnesota Department of Education. The variables included: total current expenditures, locally financed current expenditures, state equalization aid, state categorical aid, federal aid, pupils, square miles of school districts, percent minority pupils and voter override attempted, 1973-76.

Income, property values and sales ratio data were obtained from the Department of Revenue, Local Government Aids and Analysis Division Income per return was calculated from data in: The Minnesota State Individual Income Tax, Bulletin No. 39 (1972) and Bulletin No. 46 (1975), Minnesota Department of Revenue, Table 40 (1972), Table 38 (1975). Data on sales ratios for 1975 were

obtained from : 1975 School District Assessed Values, Minnesota Department of Revenue, Equalization and Review Committee, Report No. 1. For 1972 the data are obtained from: 1972 Construction of School District Ratios, Minnesota Department of Revenue, Local Government Aids and Analysis Division. Due to the classified property system in Minnesota, where different types of property are legally assessed at diverse percentages of market value, a variety of computations were necessary to arrive at estimates of market value. Census data as for Colorado were also utilized.

FOOTNOTES

1. For a survey of the literature of some years back and a contribution to specification of alternative formulations, see, for example, Alan K. Campbell and Seymour Sacks, Metropolitan America: Fiscal Patterns and Governmental Systems, New York: The Free Press, 1967. The literature has grown increasingly sophisticated in the professional economics journals since then.

2. That essentially all state school aid formulas that attempt to equalize for property value per pupil differentials across districts are special cases of a general formulation has been illustrated by, among others, Peter Jargowsky, Jay Moskowitz and Judy Simkin, "School Finance Reform; Decoding the Simulation Maze," Journal of Education Finance, 3 (Fall 1977), 199-213.

3. Martin S. Feldstein, "Wealth Neutrality and Local Choice in Public Education," American Economic Review, 65 (March 1975), 75-89; Helen F. Ladd, "Local Education Expenditures, Fiscal Capacity and the Composition of the Property Tax Base" National Tax Journal, 28 (June 1975), 145-158; Helen F. Ladd, "State-Wide Taxation of Commercial and Industrial Property for Education," National Tax Journal, 29 (June 1976), 143-153.

4. Ladd (1976), p. 147

5. Work in progress for the California Department of Education by the present authors and Professor Jay G. Chambers, University of Rochester, will attempt to incorporate cost indices in a study of this type.

6. W. Norton Grubb and Stephan Michelson, States and Schools: The Political Economy of School Finance. Lexington, Mass.: Lexington Books, 1974.

7. In states where such data on adjusted gross income per return by school districts are collected, there is usually much debate over the accuracy of these data. In Missouri, where the Education Commission of the States undertook a major school finance study, it was found that adjusted gross income per return for 1975 had a correlation of 0.75 with median family income for 1969 across the over 500 districts in the state. This correlation seems quite high given the six year time difference and the different income definition. Thus, using the adjusted gross income per return measure would seem to be satisfactory. Furthermore, given the major problems with property assessment practices in Missouri and most states, this income measure is probably as accurate as the assessed property value per pupil measure used in school aid formulas already.

8. For a discussion of cost indices and the use of such explanatory factors as the price of agricultural land, see, for example, Jay G. Chambers and Phillip E. Vincent, "Geographic Cost-of-Education Differentials," paper presented to the Seventeenth Annual Meeting of the Western Regional Science Association, Sacramento, California, February 24-26, 1978.

9. For a general discussion of recent tax rate and expenditure limitations in various states, see William H. Wilken and John J. Callahan, "State Limitations on Local School Taxes and Spending: A Paper Tiger? Mimeographed. Washington, D.C.: Legislators' Education Action Project, National Conference of State Legislatures, August 29, 1977.

10. For a seminal work that has tended to be associated more with the fiscal neutrality doctrine, despite some of the personal views of the authors, see John E. Coons, William G. Clune and Stephen D. Sugarman, Private Wealth and Public Education (Cambridge, Mass.: Harvard University Press, 1970).

11. This point has been discussed in part under a concept of "ex ante vs. ex post" fiscal neutrality by Lee S. Friedman, "The Ambiguity of Serrano: Two Concepts of Wealth-Neutrality," Working Paper $69. Berkeley, Calif.: Graduate School of Public Policy, University of California, Berkeley, April 1977.

12. See, for example, Jay G. Chambers, Allan Odden and Phillip E. Vincent, Cost-of-Education Indices Among School Districts (Denver, Colorado: Education Commission of the States, December 1976) and Allan Odden and Phillip E. Vincent, The Fiscal Impacts of Declining Enrollments (Denver, Colorado: Education Commission of the States, December 1976).

13. The present author and his colleagues at the Education Commission of the States have been fascinated by the technical direction that political compromise taken both in states where ECS has consulted on aid formula reform and other states that have undertaken reform. There has been a tendency to combine a basic foundation formula -- a nod in the direction of expenditure equality -- and a guaranteed tax base formula for possible expenditures above the foundation level -- a wave at fiscal neutrality and local fiscal control. Examples include

14. For a duscussion and empirical estimation of these effects, see, for example, Wallace E. Oates, "The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypotheses", 77 (November-December, 1969), 957-971.

15. Robert P. Inman, "Grants in a Metropolitan Economy -- A Framework for Policy," Financing the New Federalism: Revenue Sharing, Conditional Grants, and Taxation, Wallace E. Oates, editor (Baltimore, Maryland: The Johns Hopkins Press, 1975), 88-114.

16. The present authors and Professor Jay G. Chambers of the University of Rochester and Stanford University are currently developing both cost-of-education indices and estimates of fiscal capacity and response in California for the State Department of Education. These results should be available by Fall 1978.

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